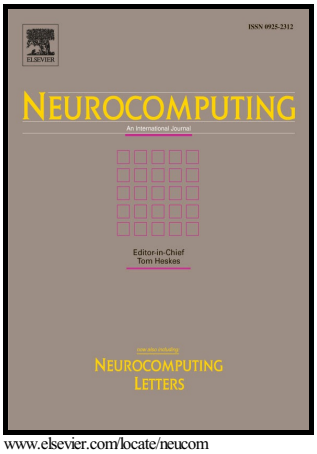

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Generating Probabilistic Predictions using Mean-Variance Estimation and Echo State Network

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Abstract

In conventional time series prediction techniques, uncertainty associated with predictions are usually ignored. Probabilistic predictors, on the other hand, can measure the uncertainty in predictions, to provide better supports for decision-making processes. A dynamic probabilistic predictor, named as echo state mean-variance estimation (ESMVE) model, is proposed. The model is constructed with two recurrent neural networks. These networks are trained into a mean estimator and a variance estimator respectively, following the algorithm of echo state networks. ESMVE generate point predictions by estimating the means of a target time series, while it also measures the uncertainty in its predictions by generating variance estimations. Experiments conducted on synthetic data sets show advantages of ESMVE over MVE models constructed with static networks. Effectiveness of ESMVE in real world prediction tasks have also been verified in our case studies.

Keywords: time series, probabilistic prediction, mean-variance estimation, echo state network, prediction interval

1. Introduction

A time series can be considered as a sequence of observations demonstrating the development of an underlying system. Time series prediction refers to the process through which the future states of such a system are forecasted based on

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